

SEQUENCE LISTING

<110> De Robertis, Edward M. Bouwmeester, Tewis

<120> Endoderm, Cardiac and Neural Inducing Factors

<130> 510015-260

<140> US 09/903,171

<141> 2001-07-11

<150> US 60/020,150

<151> 1996-06-20

<160> 10

<170> FastSEQ for Windows Version 3.0

<210> 1

<211> 270

<212> PRT

<213> Xenopus

<400> 1

Met Leu Leu Asn Val Leu Arg Ile Cys Ile Ile Val Cys Leu Val Asn 10 Asp Gly Ala Gly Lys His Ser Glu Gly Arg Glu Arg Thr Lys Thr Tyr Ser Leu Asn Ser Arg Gly Tyr Phe Arg Lys Glu Arg Gly Ala Arg Arg Ser Lys Ile Leu Leu Val Asn Thr Lys Gly Leu Asp Glu Pro His Ile Gly His Gly Asp Phe Gly Leu Val Ala Glu Leu Phe Asp Ser Thr Arg 70 75 Thr His Thr Asn Arg Lys Glu Pro Asp Met Asn Lys Val Lys Leu Phe 90 85 Ser Thr Val Ala His Gly Asn Lys Ser Ala Arg Arg Lys Ala Tyr Asn 105 Gly Ser Arg Arg Asn Ile Phe Ser Arg Arg Ser Phe Asp Lys Arg Asn 120 125 Thr Glu Val Thr Glu Lys Pro Gly Ala Lys Met Phe Trp Asn Asn Phe 135 140 Leu Val Lys Met Asn Gly Ala Pro Gln Asn Thr Ser His Gly Ser Lys 150 155 Ala Gln Glu Ile Met Lys Glu Ala Cys Lys Thr Leu Pro Phe Thr Gln 170 Asn Ile Val His Glu Asn Cys Asp Arg Met Val Ile Gln Asn Asn Leu

```
190
                                185
Cys Phe Gly Lys Cys Ile Ser Leu His Val Pro Asn Gln Gln Asp Arg
                           200
                                               205
Arg Asn Thr Cys Ser His Cys Leu Pro Ser Lys Phe Thr Leu Asn His
                        215
Leu Thr Leu Asn Cys Thr Gly Ser Lys Asn Val Val Lys Val Val Met
                    230
                                       235
Met Val Glu Glu Cys Thr Cys Glu Ala His Lys Ser Asn Phe His Gln
                245
                                   250
Thr Ala Gln Phe Asn Met Asp Thr Ser Thr Thr Leu His His
            260
                                265
                                                   270
      <210> 2
      <211> 1338
      <212> DNA
      <213> Xenopus
      <400> 2
gaatteccag caagtegete agaaacactg cagggtetag atateataca atgttactaa
                                                                      60
atgtactcag gatctgtatt atcgtctgcc ttgtgaatga tggagcagga aaacactcag
                                                                     120
180
gaggagcacg taggagcaag attctgctgg tgaatactaa aggtcttgat gaaccccaca
                                                                     240
ttgggcatgg tgattttcgc ttagtagctg aactatttga ttccaccaga acacatacaa
                                                                     300
acagaaaaga gccagacatg aacaaagtca agcttttctc aacagttgcc catggaaaca
                                                                     360
aaagtgcaag aagaaaagct tacaatggtt ctagaaggaa tatttttcct cgccgttctt
                                                                     420
ttgataaaag aaatacagag gttactgaaa agcctggtgc caagatgttc tggaacaatt
                                                                     480
ttttggttaa aatgaatgga gccccacaga atacaagcca tggcagtaaa gcacaggaaa
                                                                     540
taatgaaaga agettgeaaa acettgtttt teaeteagaa tattgtaeat gaaaactgtg
                                                                     600
acaggatggt gatacagaac aatctgtgct ttggtaaatg catctctctc catgttccaa
                                                                     660
atcagcaaga tcgacgaaat acttgttccc attgcttgcc gtccaaattt accctgaacc
                                                                     720
acctgacgct gaattgtact ggatctaaga atgtagtaaa ggttgtcatg atggtagagg
                                                                     780
aatqcacqtq tqaaqctcat aaqaqcaact tccaccaaac tqcacaqttt aacatqqata
                                                                     840
                                                                     900
catctactac cctgcaccat taaaggactg ccatacagta tggaaatgcc cttttgttgg
aatatttgtt acatactatg catctaaagc attatgttgc cttctatttc atataaccac
                                                                     960
atggaataag gattgtatga attataatta acaaatggca ttttgtgtaa catgcaagat
                                                                    1020
ctctgttcca tcagttgcaa gataaaaggc aatatttgtt tgactttttt tctacaaaat
                                                                    1080
gaatacccaa atatatgata agataatggg gtcaaaactg ttaaggggta atgtaataat
                                                                    1140
agggactaag tttgcccagg agcagtgacc cataacaacc aatcagcagg tatgatttac
                                                                    1200
tggtcacctg tttaaaagca aacatcttat tggttgctat gggttactgc ttctgggcaa
                                                                    1260
aatgtgtgcc tcataggggg gttagtgttt tgtgtactga ataaattgta tttatttcat
                                                                    1320
tgttacaaaa aaaaaaaa
                                                                    1338
      <210> 3
      <211> 318
      <212> PRT
      <213> Xenopus frazzled
      <400> 3
Met Ser Arg Thr Arg Lys Val Asp Ser Leu Leu Leu Leu Ala Ile Pro
1
                5
```

Gly Leu Ala Leu Leu Leu Pro Asn Ala Tyr Cys Ala Ser Cys Glu

25

20

```
Pro Val Arg Ile Pro Met Cys Lys Ser Met Pro Trp Asn Met Thr Lys
                            40
Met Pro Asn His Leu His His Ser Thr Gln Ala Asn Ala Ile Leu Ala
Ile Glu Gln Phe Glu Gly Leu Leu Thr Thr Glu Cys Ser Gln Asp Leu
                    70
                                         75
Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys Thr Ile Asp Phe
                85
                                    90
Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys Glu Arg Ala Arg
                                105
Ala Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His Thr Trp Pro Glu
                            120
Ser Leu Ala Cys Glu Glu Leu Pro Val Tyr Asp Arg Gly Val Cys Ile
                        135
Ser Pro Glu Ala Ile Val Thr Val Glu Gln Gly Thr Asp Ser Met Pro
                    150
                                        155
Asp Phe Ser Met Asp Ser Asn Asn Gly Asn Cys Gly Ser Gly Arg Glu
                165
                                    170
His Cys Lys Cys Lys Pro Met Lys Ala Thr Gln Lys Thr Tyr Leu Lys
            180
                                185
                                                     190
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Val
                            200
                                                 205
Lys Cys His Asp Ala Thr Ala Ile Val Glu Val Lys Glu Ile Leu Lys
                        215
                                            220
Ser Ser Leu Val Asn Ile Pro Lys Asp Thr Val Thr Leu Tyr Thr Asn
                                        235
Ser Gly Cys Leu Cys Pro Gln Leu Val Ala Asn Glu Glu Tyr Ile Ile
                245
                                    250
Met Gly Tyr Glu Asp Lys Glu Arg Thr Arg Leu Leu Val Glu Gly
                                265
Ser Leu Ala Glu Lys Trp Arg Asp Arg Leu Ala Lys Lys Val Lys Arg
                            280
                                                 285
Trp Asp Gln Lys Leu Arg Arg Pro Arg Lys Ser Lys Asp Pro Val Ala
                        295
Pro Ile Pro Asn Lys Asn Ser Asn Ser Arg Gln Ala Arg Ser
305
                    310
                                        315
      <210> 4
      <211> 1875
     <212> DNA
     <213> Xenopus frazzled
     <400> 4
gaattccctt tcacacagga ctcctggcag aggtgaatgg ttagccctat ggatttggtt
                                                                        60
tgttgatttt gacacatgat tgattgcttt cagataggat tgaaggactt ggatttttat
                                                                       120
ctaattctgc acttttaaat tatctgagta attgttcatt ttgtattgga tgggactaaa
                                                                       180
gataaactta actccttgct tttgacttgc ccataaacta taaggtgggg tgagttgtag
                                                                       240
ttgcttttac atgtgcccag attttccctg tattccctgt attccctcta aagtaagect
                                                                       300
acacatacag gttgggcaga ataacaatgt ctcgaacaag gaaagtggac tcattactgc
                                                                       360
```

420

tactggccat acctggactg gegettetet tattacccaa tgettactgt gettegtgtg

```
agcctgtgcg gatccccatg tgcaaatcta tgccatggaa catgaccaag atgcccaacc
                                                                       480
atctccacca cagcactcaa gccaatgcca tcctggcaat tgaacagttt gaaggtttgc
                                                                       540
tgaccactga atgtagccag gaccttttgt tctttctgtg tgccatgtat gcccccattt
                                                                       600
gtaccatcga tttccagcat gaaccaatta agccttgcaa gtccgtgtgc gaaagggcca
                                                                       660
gggccggctg tgagcccatt ctcataaagt accggcacac ttggccagag agcctggcat
                                                                       720
gtgaagaget geeegtatat gacagaggag tetgeatete eecagagget ategteacag
                                                                       780
tggaacaagg aacagattca atgccagact tctccatgga ttcaaacaat ggaaattgcg
                                                                       840
gaagcggcag ggagcactgt aaatgcaagc ccatgaaggc aacccaaaag acgtatctca
                                                                       900
                                                                       960
agaataatta caattatgta atcagagcaa aagtgaaaga ggtgaaagtg aaatgccacg
acgcaacagc aattgtggaa gtaaaggaga ttctcaagtc ttccctagtg aacattccta
                                                                      1020
aagacacagt gacactgtac accaactcag gctgcttgtg cccccagctt gttgccaatg
                                                                      1080
aggaatacat aattatgggc tatgaagaca aagagcgtac caggcttcta ctagtggaag
                                                                      1140
gateettgge egaaaaatgg agagategte ttgetaagaa agteaagege tgggateaaa
                                                                      1200
agettegaeg teccaggaaa ageaaagaee eegtggetee aatteeeaae aaaaacagea
                                                                      1260
attccagaca aggggtagt tagactaacg gaaaggtgta tggaaactct atggactttg
                                                                      1320
aaactaagat ttgcattgtt ggaagagcaa aaaagaaatt gcactacagc acgttatatt
                                                                      1380
ctattgttta ctacaagaag ctggtttagt tgattgtagt tctcctttcc ttctttttt
                                                                      1440
ttataactat atttgcacgt gttcccaggc aattgtttta ttcaacttcc agtgacagag
                                                                      1500
cagtgactga atgtctcagc ctaaagaagc tcaattcatt tctgatcaac taatggtgac
                                                                      1560
aagtgtttga tacttgggga aagtgaacta attgcaatgg taaatcagag aaaagttgac
                                                                      1620
caatgttgct tttcctgtag atgaacaagt gagagatcac atttaaatga tgatcacttt
                                                                      1680
ccatttaata ctttcagcag ttttagttag atgacatgta ggatgcacct aaatctaaat
                                                                      1740
attttatcat aaatgaagag ctggtttaga ctgtatggtc actgttggga aggtaaatgc
                                                                      1800
ctactttgtc aattctgttt taaaaattgc ctaaataaat attaagtcct aaataaaaaa
                                                                      1860
aaaaaaaaa aaaaa
                                                                      1875
```

<210> 5

<211> 896

<212> PRT

<213> Xenopus

<400> 5

Met Leu Leu Phe Arg Ala Ile Pro Met Leu Leu Gly Leu Met Val Leu Gln Thr Asp Cys Glu Ile Ala Gln Tyr Tyr Ile Asp Glu Glu Glu Pro Pro Gly Thr Val Ile Ala Val Leu Ser Gln His Ser Ile Phe Asn Thr Thr Asp Ile Pro Ala Thr Asn Phe Arg Leu Met Lys Gln Phe 60 55 Asn Asn Ser Leu Ile Gly Val Arg Glu Ser Asp Gly Gln Leu Ser Ile 70 75 Met Glu Arg Ile Asp Arg Glu Gln Ile Cys Arg Gln Ser Leu His Cys 90 Asn Leu Ala Leu Asp Val Val Ser Phe Ser Lys Gly His Phe Lys Leu 105 Leu Asn Val Lys Val Glu Val Arg Asp Ile Asn Asp His Ser Pro His 120 125 Phe Pro Ser Glu Ile Met His Val Glu Val Ser Glu Ser Ser Ser Val 135 Gly Thr Arg Ile Pro Leu Glu Ile Ala Ile Asp Glu Asp Val Gly Ser

145					150					155					160
Asn	Ser	Ile	Gln	Asn 165	Phe	Gln	Ile	Ser	Asn 170	Asn	Ser	His	Phe	Ser 175	Ile
Asp	Val	Leu	Thr 180	Arg	Ala	Asp	Gly	Val 185	Lys	Tyr	Ala	Asp	Leu 190	Val	Leu
Met	Arg	Glu 195	Leu	Asp	Arg	Glu	Ile 200	Gln	Pro	Thr	Tyr	Ile 205	Met	Glu	Leu
Leu	Ala 210	Met	Asp	Gly	Gly	Val 215	Pro	Ser	Leu	Ser	Gly 220	Thr	Ala	Val	Val
Asn 225	Ile	Arg	Val	Leu	Asp 230	Phe	Asn	Asp	Asn	Ser 235	Pro	Val	Phe	Glu	Arg 240
Ser	Thr	Ile	Ala	Val 245	Asp	Leu	Val	Glu	Asp 250	Ala	Pro	Leu	Gly	Tyr 255	Leu
			260				Asp	265	_		_		270		
		275	_				Leu 280					285	_		
	290					295	Gly				300		_		
305				_	310		Tyr			315					320
				325			Ala		330	-				335	
			340	_			Pro	345					350		
		355		_			Tyr 360					365		_	
	370					375	Thr				380		_		
385					390		Tyr			395					400
		_		405		_	Met		410					415	_
			420			_	Ser	425					430	_	
		435			_		Lys 440	_	_	-		445			
	450					455	Val				460				
465					470		Pro			475					480
				485		_	Gln		490	_			_	495	
			500			_	Gln	505					510		
		515		_			Arg 520			_		525	_	_	
	530				_	535	Glu				540			_	
Pro 545	GIn	Leu	ser	Thr	Arg 550	Vai	Gln	Leu	Asn	Leu 555	Arg	11e	Val	Asp	Gln 560

510015-260.TXT

```
Asn Asp Asn Cys Pro Val Ile Thr Asn Pro Leu Leu Asn Asn Gly Ser
                                   570
                565
Gly Glu Val Leu Leu Pro Ile Ser Ala Pro Gln Asn Tyr Leu Val Phe
                               585
Gln Leu Lys Ala Glu Asp Ser Asp Glu Gly His Asn Ser Gln Leu Phe
                            600
Tyr Thr Ile Leu Arg Asp Pro Ser Arg Leu Phe Ala Ile Asn Lys Glu
                       615
Ser Gly Glu Val Phe Leu Lys Lys Gln Leu Asn Ser Asp His Ser Glu
                    630
                                        635
Asp Leu Ser Ile Val Val Ala Val Tyr Asp Leu Gly Arg Pro Ser Leu
                645
                                    650
Ser Thr Asn Ala Thr Val Lys Phe Ile Leu Thr Asp Ser Phe Pro Ser
                                665
Asn Val Glu Val Val Ile Leu Gln Pro Ser Ala Glu Glu Gln His Gln
        675
                            680
                                                685
Ile Asp Met Ser Ile Ile Phe Ile Ala Val Leu Ala Gly Gly Cys Ala
                        695
                                            700
Leu Leu Leu Ala Ile Phe Phe Val Ala Cys Thr Cys Lys Lys Lys
                    710
                                        715
Ala Gly Glu Phe Lys Gln Val Pro Glu Gln His Gly Thr Cys Asn Glu
               725
                                    730
Glu Arg Leu Leu Ser Thr Pro Ser Pro Gln Ser Val Ser Ser Ser Leu
                            745
Ser Gln Ser Glu Ser Cys Gln Leu Ser Ile Asn Thr Glu Ser Glu Asn
                           760
                                                765
Cys Ser Val Ser Ser Asn Gln Glu Gln His Gln Gln Thr Gly Ile Lys
                        775
His Ser Ile Ser Val Pro Ser Tyr His Thr Ser Gly Trp His Leu Asp
                                        795
                   790
Asn Cys Ala Met Ser Ile Ser Gly His Ser His Met Gly His Ile Ser
               805
                                    810
Thr Lys Val Gln Trp Ala Lys Glu Ile Val Thr Ser Met Thr Val Thr
Leu Ile Leu Val Glu Asn Gln Lys Arg Arg Ala Leu Ser Ser Gln Cys
                            840
Arg His Lys Pro Val Leu Asn Thr Gln Met Asn Gln Gln Gly Ser Asp
                       855
                                            860
Met Pro Ile Thr Ile Ser Ala Thr Glu Ser Thr Arg Val Gln Lys Met
                   870
                                        875
Gly Thr Ala His Cys Asn Met Lys Arg Ala Ile Asp Cys Leu Thr Leu
                885
                                    890
```

<210> 6

<211> 3657

<212> DNA

<213> Xenopus

<400> 6

gaatteeeag agatgaaete ettgagattg tittaaatga etgeaggtet ggaaggatte acattgeeae actgitteta ggeatgaaaa aactgeaagt tieaaetitg tittitggige

Page 6

```
aactttgatt cttcaagatg ctgcttctct tcagagccat tccaatgctg ctgttgggac
                                                                       180
tgatggtttt acaaacagac tgtgaaattg cccagtacta catagatgaa gaagaacccc
                                                                       240
ctggcactgt aattgcagtg ttgtcacaac actccatatt taacactaca gatatacctg
                                                                       300
caaccaattt ccgtctaatg aagcaattta ataattccct tatcggagtc cgtgagagtg
                                                                       360
atgggcagct gagcatcatg gagaggattg accgggagca aatctgcagg cagtcccttc
                                                                       420
actgcaacct ggctttggat gtggtcagct tttccaaagg acacttcaag cttctgaacg
                                                                       480
tgaaagtgga ggtgagagac attaatgacc atagccctca ctttcccagt gaaataatgc
                                                                       540
atgtggaggt gtctgaaagt tcctctgtgg gcaccaggat tcctttagaa attgcaatag
                                                                       600
                                                                       660
atgaagatgt tgggtccaac tccatccaga actttcagat ctcaaataat agccacttca
                                                                       720
gcattgatgt gctaaccaga gcagatgggg tgaaatatgc agatttagtc ttaatgagag
aactggacag ggaaatccag ccaacataca taatggagct actagcaatg gatgggggtg
                                                                       780
taccatcact atctggtact gcagtggtta acatccgagt cctggacttt aatgataaca
                                                                       840
                                                                       900
gcccagtgtt tgagagaagc accattgctg tggacctagt agaggatgct cctctgggat
                                                                       960
accttttgtt ggagttacat gctactgacg atgatgaagg agtgaatgga gaaattgttt
                                                                      1020
atggattcag cactttggca tctcaagagg tacgtcagct atttaaaatt aactccagaa
ctggcagtgt tactcttgaa ggccaagttg attttgagac caagcagact tacgaatttg
                                                                      1080
aggtacaagc ccaagatttg ggccccaacc cactgactgc tacttgtaaa gtaactgttc
                                                                      1140
                                                                      1200
atatacttga tgtaaatgat aataccccag ccatcactat tacccctctg actactgtaa
                                                                      1260
atgcaggagt tgcctatatt ccagaaacag ccacaaagga gaactttata gctctgatca
                                                                      1320
gcactactga cagageetet ggatetaatg gacaagtteg etgtactett tatggacatg
agcactttaa actacagcaa gcttatgagg acagttacat gatagttacc acctctactt
                                                                      1380
tagacaggga aaacatagca gcgtactctt tgacagtagt tgcagaagac cttggcttcc
                                                                      1440
                                                                      1500
cctcattgaa gaccaaaaag tactacacag tcaaggttag tgatgagaat gacaatgcac
                                                                      1560
ctgtattttc taaaccccag tatgaagctt ctattctgga aaataatgct ccaggctctt
atataactac agtgatagcc agagactctg atagtgatca aaatggcaaa gtaaattaca
                                                                      1620
gacttgtgga tgcaaaagtg atgggccagt cactaacaac atttgtttct cttgatgcgg
                                                                      1680
actotggagt attgagaget gttaggtett tagactatga aaaacttaaa caactggatt
                                                                      1740
ttgaaattga agctgcagac aatgggatcc ctcaactctc cactcgcgtt caactaaatc
                                                                      1800
tcagaatagt tgatcaaaat gataattgcc ctgtgataac taatcctctt cttaataatg
                                                                      1860
gctcgggtga agttctgctt cccatcagcg ctcctcaaaa ctatttagtt ttccagctca
                                                                      1920
                                                                      1980
aagccgagga ttcagatgaa gggcacaact cccagctgtt ctataccata ctgagagatc
caagcagatt gtttgccatt aacaaagaaa gtggtgaagt gttcctgaaa aaacaattaa
                                                                      2040
                                                                      2100
actctgacca ttcagaggac ttgagcatag tagttgcagt gtatgacttg ggaagacctt
                                                                      2160
cattatccac caatgctaca gttaaattca tcctcaccga ctcttttcct tctaacgttg
                                                                      2220
aagtcgttat tttgcaacca tctgcagaag agcagcacca gatcgatatg tccattatat
                                                                      2280
teattgeagt getggetggt ggttgtgett tgetaetttt ggeeatettt tttgtggeet
gtacttgtaa aaagaaagct ggtgaattta agcaggtacc tgaacaacac ggaacatgca
                                                                      2340
                                                                      2400
atgaagaacg cetgttaage acceeatete eccagteggt etettettet ttgteteagt
ctgagtcatg ccaactctcc atcaatactg aatctgagaa ttgcagcgtg tcctctaacc
                                                                      2460
aagagcagca tcagcaaaca ggcataaagc actccatctc tgtaccatct tatcacacat
                                                                      2520
                                                                      2580
ctggttggca cctggacaat tgtgcaatga gcataagtgg acattctcac atggggcaca
ttagtacaaa ggtacagtgg gcaaaggaga tagtgacttc aatgacagtg actctgatac
                                                                      2640
tagtggagaa tcacaaaaga agagcattga gcagccaatg caggcacaag ccagtgctca
                                                                      2700
                                                                      2760
atacacagat gaatcagcag ggttccgaca tgccgataac tatttcagcc accgaatcaa
                                                                      2820
caagggtcca gaaaatggga actgcacatt gcaatatgaa aagggctata gactgtctta
                                                                      2880
ctctgtagct cctgctcatt acaataccta ccatgcaaga atgcctaacc tgcacatacc
gaaccatacc cttagagacc cttattacca tatcaataat cctgttgcta atcggatgca
                                                                      2940
                                                                      3000
ggcggaatat gaaagagatt tagtcaacag aagtgcaacg ttatctccgc agagatcgtc
tagcagatac caagaattca attacagtcc gcagatatca agacagcttc atccttcaga
                                                                      3060
aattgctaca accttttaat cattaggcat gcaagtgaga atgcacaaag gcaagtgctt
                                                                      3120
tagcatgaaa gctaaatata tggagtctcc cctttccctc tgatggatgg ggggagacac
                                                                      3180
```

```
aggacagtgc ataaatatac agctgctttc tatttgcatt tcacttggga attttttgtt
                                                                      3240
ttttttacat atttatttt cctgaattga atgtgacatt gtcctgtcac ctaactagca
                                                                     3300
attaaatcca cagacctaca gtcaaatatt tgagggcccc tgaaacagca catcagtcag
                                                                     3360
gacctaaagt ggccttttta cttttagcag ctcctgggtc tgccctctgt gttaatcagc
                                                                     3420
ccctggtcaa gtcctgagta ggatcatggc gtttttatat gcatctcacc tactttggac
                                                                     3480
gtgatttaca cataatagga aacgcttggt ttcagtgaag tctgtgttgt atatattctg
                                                                     3540
ttatatacac gcattttgtg tttgtgtata tatttcaagt ccattcagat atgtgtatat
                                                                     3600
agtgcagacc ttgtaaaatt aatattctga tactttttcc tcaataaata tttaaat
                                                                     3657
```

<210> 7

<211> 323

<212> PRT

<213> Mouse FRZB-1

<400> 7

```
Met Val Cys Cys Gly Pro Gly Arg Met Leu Leu Gly Trp Ala Gly Leu
                                    10
Leu Val Leu Ala Ala Leu Cys Leu Leu Gln Val Pro Gly Ala Gln Ala
            20
                                25
Ala Ala Cys Glu Pro Val Arg Ile Pro Leu Cys Lys Ser Leu Pro Trp
                            40
Asn Met Thr Lys Met Pro Asn His Leu His His Ser Thr Gln Ala Asn
                        55
Ala Ile Leu Ala Met Glu Gln Phe Glu Gly Leu Leu Gly Thr His Cys
                    70
                                        75
Ser Pro Asp Leu Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys
Thr Ile Asp Phe Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys
            100
                                105
Glu Arg Ala Arg Gln Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His
                            120
                                                 125
Ser Trp Pro Glu Ser Leu Ala Cys Asp Glu Leu Pro Val Tyr Asp Arg
                                            140
                        135
Gly Val Cys Ile Ser Pro Glu Ala Ile Val Thr Ala Asp Gly Ala Asp
                    150
                                        155
Phe Pro Met Asp Ser Ser Thr Gly His Cys Arg Gly Ala Ser Ser Glu
                165
                                    170
Arg Cys Lys Cys Lys Pro Val Arg Ala Thr Gln Lys Thr Tyr Phe Arg
                                185
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Met
Lys Cys His Asp Val Thr Ala Val Val Glu Val Lys Glu Ile Leu Lys
                        215
Ala Ser Leu Val Asn Ile Pro Arg Asp Thr Val Asn Leu Tyr Thr Thr
                    230
                                        235
Ser Gly Cys Leu Cys Pro Pro Leu Thr Val Asn Glu Glu Tyr Val Ile
                245
                                    250
Met Gly Tyr Glu Asp Glu Glu Arg Ser Arg Leu Leu Leu Val Glu Gly
                                265
Ser Ile Ala Glu Lys Trp Lys Asp Arg Leu Gly Lys Lys Val Lys Arg
       275
                            280
```

 Trp
 Asp
 Met
 Lys
 Leu
 Arg
 His
 Leu
 Gly
 Leu
 Gly
 Lys
 Thr
 Asp
 Ala
 Ser

 290
 295
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 300
 3

<210> 8 <211> 2176 <212> DNA <213> Mouse FRZB-1

<400> 8

60 aagcctggga ccatggtctg ctgcggcccg ggacggatgc tgctaggatg ggccgggttg 120 ctaqtcctqq ctqctctctq cctqctccaq gtqcccggaq ctcaggctqc agcctgtgag cctgtccgca tcccgctgtg caagtccctt ccctggaaca tgaccaagat gcccaaccac 180 ctgcaccaca gcacccaggc taacgccatc ctggccatgg aacagttcga agggctgctg 240 ggcacccact gcagcccgga tcttctcttc ttcctctgtg caatgtacgc acccatttgc 300 accatcgact tccagcacga gcccatcaag ccctgcaagt ctgtgtgtga gcgcgcccga 360 420 cagggctgcq agcccattct catcaagtac cgccactcgt ggccggaaag cttggcctgc gacgagetge eggtgtaega eegeggegtg tgeatetete etgaggeeat egteaeegeg 480 gacggagcgg attiticctat ggattcaagt actggacact gcagaggggc aagcagcgaa 540 600 cgttgcaaat gtaagcctgt cagagctaca cagaagacct atttccggaa caattacaac 660 tatgtcatcc gggctaaagt taaagaggta aagatgaaat gtcatgatgt gaccgccgtt 720 gtggaagtga aggaaattct aaaggcatca ctggtaaaca ttccaaggga caccgtcaat 780 ctttatacca cctctgctg cctctgtcct ccacttactg tcaatgagga atatgtcatc atgggctatg aagacgagga acgttccagg ttactcttgg tagaaggctc tatagctgag 840 aagtggaagg atcggcttgg taagaaagtc aagcgctggg atatgaaact ccgacacctt 900 ggactgggta aaactgatgc tagcgattcc actcagaatc agaagtctgg caggaactct 960 1020 aatccccggc cagcacgcag ctaaatcctg aaatgtaaaa ggccacaccc acggactccc ttctaagact ggcgctggtg gactaacaaa ggaaaaccgc acagttgtgc tcgtgaccga 1080 ttgtttaccg cagacaccgc gtggctaccg aagttacttc cggtcccctt tctcctgctt 1140 cttaatggcg tggggttaga tcctttaata tgttatatat tctgtttcat caatcacgtg 1200 gggactgttc ttttgcaacc agaatagtaa attaaatatg ttgatgctaa ggtttctgta 1260 ctggactccc tgggtttaat ttggtgttct gtaccctgat tgagaatgca atgtttcatg 1320 taaagagaga atcctggtca tatctcaaga actagatatt gctgtaagac agcctctgct 1380 gctgcgctta tagtcttgtg tttgtatgcc tttgtccatt tccctcatgc tgtgaaagtt 1440 atacatgttt ataaaggtag aacggcattt tgaaatcaga cactgcacaa gcagagtagc 1500 1560 ccaacaccag gaagcattta tgaggaaacg ccacacagca tgacttattt tcaagattgg 1620 1680 cacactggaa tcagtagccc ttgagccatt aacagcagtg ttcttctggc aagtttttga tttgttcata aatgtattca cgagcattag agatgaactt ataactagac atctgttgtt 1740 atctctatag ctctgcttcc ttctaaatca aacccattgt tggatgctcc ctctccattc 1800 1860 ataaataaat ttggcttgct gtattggcca ggaaaagaaa gtattaaagt atgcatgcat gtgcaccagg gtgttattta acagaggtat gtaactctat aaaagactat aatttacagg 1920 1980 acacggaaat gtgcacattt gtttactttt tttcttcctt ttgctttggg cttgtgattt tggtttttgg tgtgtttatg tctgtatttt ggggggtggg taggtttaag ccattgcaca 2040 2100 ttcaagttga actagattag agtagactag gctcattggc ctagacatta tgatttgaat ttgtgttgtt taatgctcca tcaagatgtc taataaaagg aatatggttg tcaacagaga 2160 cgacaacaac aacaaa 2176

<210> 9 <211> 325 <212> PRT <213> Human FRZB-1

<400> 9 Met Val Cys Gly Ser Pro Gly Gly Met Leu Leu Leu Arg Ala Gly Leu Leu Ala Leu Ala Ala Leu Cys Leu Leu Arg Val Pro Gly Ala Arg Ala 25 Ala Ala Cys Glu Pro Val Arg Ile Pro Leu Cys Lys Ser Leu Pro Trp Asn Met Thr Lys Met Pro Asn His Leu His His Ser Thr Gln Ala Asn 60 55 Ala Ile Leu Ala Ile Glu Gln Phe Glu Gly Leu Leu Gly Thr His Cys 70 75 Ser Pro Asp Leu Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys 90 85 Thr Ile Asp Phe Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys 105 Glu Arg Ala Arg Gln Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His 120 125 Ser Trp Pro Glu Asn Leu Ala Cys Glu Glu Leu Pro Val Tyr Asp Arg 135 140 Gly Val Cys Ile Ser Pro Glu Ala Ile Val Thr Ala Asp Gly Ala Asp 150 155 Phe Pro Met Asp Ser Ser Asn Gly Asn Cys Arg Gly Ala Ser Ser Glu 170 165 Arg Cys Lys Cys Lys Pro Ile Arg Ala Thr Gln Lys Thr Tyr Phe Arg 185 Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Ile Lys Thr 200 Lys Cys His Asp Val Thr Ala Val Val Glu Val Lys Glu Ile Leu Lys 215 Ser Ser Leu Val Asn Ile Pro Arg Asp Thr Val Asn Leu Tyr Thr Ser 230 235 Ser Gly Cys Leu Cys Pro Pro Leu Asn Val Asn Glu Glu Tyr Ile Ile 250 245 Met Gly Tyr Glu Asp Glu Glu Arg Ser Arg Leu Leu Val Glu Gly 265 260 Ser Ile Ala Glu Lys Trp Lys Asp Arg Leu Gly Lys Lys Val Lys Arg 280 Trp Asp Met Lys Leu Arg His Leu Gly Leu Ser Lys Ser Asp Ser Ser 300 295 Asn Ser Asp Ser Thr Gln Ser Gln Lys Ser Gly Arg Asn Ser Asn Pro

325

310

<210> 10 <211> 1893

Arg Gln Ala Arg Asn

315

320

<212> DNA <213> Human FRZB-1

<400> 10

ggcggagcgg gccttttggc gtccactgcg cggctgcacc ctgccccatc tgccgggatc 60 atggtctgcg gcagcccggg agggatgctg ctgctgcggg ccgggctgct tgccctggct 120 getetetgee tgeteegggt geeegggget egggetgeag cetgtgagee egteegeate 180 cccctgtgca agtccctgcc ctggaacatg actaagatgc ccaaccacct gcaccacagc 240 300 actcaggeca acgecatect ggccategag cagttegaag gtetgetggg cacceaetge agccccgatc tgctcttctt cctctgtgcc atgtacgcgc ccatctgcac cattgacttc 360 cagcacgage ccatcaagee etgtaagtet gtgtgegage gggeeeggea gggetgtgag 420 cccatactca tcaagtaccg ccactcgtgg ccggagaacc tggcctgcga ggagctgcca 480 540 gtgtacgaca ggggcgtgtg catctctccc gaggccatcg ttactgcgga cggagctgat 600 tttcctatgg attctagtaa cggaaactgt agaggggcaa gcagtgaacg ctgtaaatgt aagcetatta gagetacaca gaagacetat tteeggaaca attacaacta tgteattegg 660 gctaaagtta aagagataaa gactaagtgc catgatgtga ctgcagtagt ggaggtgaag 720 780 gagattetaa agteetetet ggtaaacatt eeaegggaca etgteaacet etataeeage 840 totggotgcc totgccotcc acttaatgtt aatgaggaat atatcatcat gggotatgaa 900 gatgaggaac gttccagatt actcttggtg gaaggctcta tagctgagaa gtggaaggat cgactcggta aaaaagttaa gcgctgggat atgaagcttc gtcatcttgg actcagtaaa 960 agtgattcta gcaatagtga ttccactcag agtcagaagt ctggcaggaa ctcgaacccc 1020 1080 cggcaagcac gcaactaaat cccgaaatac aaaaagtaac acagtggact tcctattaag acttacttgc attgctggac tagcaaagga aaattgcact attgcacatc atattctatt 1140 gtttactata aaaatcatgt gataactgat tattacttct gtttctcttt tggtttctgc 1200 ttctctcttc tctcaacccc tttgtaatgg tttgggggca gactcttaag tatattgtga 1260 gttttctatt tcactaatca tgagaaaaac tgttcttttg caataataat aaattaaaca 1320 tgctgttacc agagcctctt tgctgagtct ccagatgtta atttactttc tgcaccccaa 1380 ttgggaatgc aatattggat gaaaagagag gtttctggta ttcacagaaa gctagatatg 1440 1500 ccttaaaaca tactctgccg atctaattac agccttattt ttgtatgcct tttgggcatt ctcctcatgc ttagaaagtt ccaaatgttt ataaaggtaa aatggcagtt tgaagtcaaa 1560 tgtcacatag gcaaagcaat caagcaccag gaagtgttta tgaggaaaca acacccaaga 1620 1680 tgaattattt ttgagactgt caggaagtaa aataaatagg agcttaagaa agaacatttt gcctgattga gaagcacaac tgaaaccagt agccgctggg gtgttaatgg tagcattctt 1740 1800 cttttggcaa tacatttgat ttgttcatga atatattaat cagcattaga gaaatgaatt ataactagac atctgctgtt atcaccatag ttttgtttaa tttgcttcct tttaaataaa 1860 1893 cccattggtg aaagtcaaaa aaaaaaaaaa aaa